CLAIMS

1. A method for measuring impedance of a tissue, comprising:

charging a capacitor to a potential;

discharging the capacitor for a discharge period through the tissue;

measuring a voltage drop on the capacitor over the discharge period; and

determining an impedance of the tissue responsive to the potential, the voltage drop, and the discharge period.

2. A method according to claim 1, wherein charging the capacitor comprises:

providing a first circuit which is adapted to charge the capacitor to a first voltage;

providing a second circuit which is adapted to charge the capacitor to a second voltage;

measuring the potential on the capacitor;

determining a first charging period for the first circuit and a second charging period for the second circuit, responsive to the potential, so that the first and second charging periods substantially total to the predetermined period and so that the first and second voltages substantially total to the predetermined differential potential; and

operating the first circuit for the first charging period and the second circuit for the second charging period, the circuits being operated sequentially.

3. A method according to claim 2, wherein the first circuit comprises a resistive element through which the capacitor is charged by a substantially direct current (DC), and wherein the second circuit comprises an inductor, a switching element, and a diode, which are

operative to generate a substantially alternating current (AC) and to rectify the AC so as to charge the capacitor.

4. A method for stimulating a tissue, comprising:

charging a capacitor to a first potential;

discharging the capacitor for a first discharge period through the tissue;

measuring a voltage drop on the capacitor over the first discharge period;

determining an impedance of the tissue responsive to the first potential, the voltage drop, and the first discharge period;

determining a second potential and a second discharge period, responsive to the impedance and a predetermined desired tissue stimulation level;

charging the capacitor to the second potential; and

discharging the capacitor for the second discharge period through the tissue.

5. A method according to claim 4, wherein discharging the capacitor for the first discharge period and discharging the capacitor for the second discharge period each comprise discharging alternating pulses through the tissue, each alternating pulse comprising a positive-going pulse followed by a negative-going pulse, so that a time between the positive-going pulse and the negative-going pulse is substantially equal to half a period of the alternating pulses.

6. A method according to claim 4, wherein discharging the capacitor for the first discharge period and discharging the capacitor for the second discharge period each comprise discharging biphasic pulses through the tissue, each biphasic pulse comprising a positive-going pulse followed by a negative-going pulse, so that a time between the positive-going pulse and the negative-going

pulse is substantially less than half a period of the biphasic pulses.

7. A method according to claim 6, wherein discharging the biphasic pulses comprises discharging a first biphasic pulse comprising a first positive-going pulse followed by a first negative-going pulse, followed by a second biphasic pulse comprising a second negative-going pulse followed by a second positive-going pulse.

8. A method according to claim 4, wherein discharging the capacitor for the first discharge period and discharging the capacitor for the second discharge period each comprise discharging the capacitor responsive to a control signal generated by the tissue.

9. A method according to claim 4, wherein the second discharge period is subsequent to the first discharge period.

10. Apparatus for measuring impedance of a tissue, comprising:

a capacitor; and

circuitry which is adapted to:

charge the capacitor to a potential,

discharge the capacitor for a discharge period through the tissue,

measure a voltage drop on the capacitor over the discharge period, and

determine an impedance of the tissue responsive to the potential, the voltage drop, and the discharge period.

11. Apparatus according to claim 10, wherein the circuitry comprises:

a first circuit which is adapted to charge the capacitor to a first voltage;

a second circuit which is adapted to charge the

capacitor to a second voltage;

and wherein the circuitry is further adapted to measure the potential on the capacitor,

determine a first charging period for the first circuit and a second charging period for the second circuit, responsive to the potential, so that the first and second charging periods substantially total to the predetermined period and so that the first and second voltages substantially total to the predetermined differential potential, and

operate the first circuit for the first charging period and the second circuit for the second charging period, the circuits being operated sequentially.

12. Apparatus according to claim 11, wherein the first circuit comprises a resistive element through which the capacitor is charged by a substantially direct current (DC), and wherein the second circuit comprises an inductor, a switching element, and a diode, which are operative to generate a substantially alternating current (AC) and to rectify the AC so as to charge the capacitor.

13. Apparatus for changing a potential across a capacitor by a predetermined differential potential in a predetermined time period, comprising:

a first circuit which is adapted to charge the capacitor to a first voltage;

a second circuit which is adapted to charge the capacitor to a second voltage; and

a controller which measures the potential on the capacitor, and responsive thereto and to the predetermined differential potential and the predetermined time period operates the first circuit and the second circuit sequentially for respective periods of time substantially totaling the predetermined time period so as to charge the capacitor by the predetermined

differential potential substantially totaling the first and the second voltages.

14. Apparatus according to claim 13, and comprising a memory wherein is stored a first charging rate for the first circuit and a second charging rate for the second circuit, and wherein the controller is adapted to determine the respective periods of time responsive to the first and the second charging rates.

15. Apparatus according to claim 13, wherein the first circuit dissipates a first energy to charge the capacitor to the first voltage and the second circuit dissipates a second energy to charge the capacitor to the second voltage, and wherein the controller is adapted to determine the respective periods of time responsive to the first and the second energies.

16. Apparatus according to claim 15, wherein the controller is adapted to determine the respective periods so that a sum of the first and the second energies is a minimum.

17. Apparatus according to claim 16, wherein the first circuit comprises a resistive element through which the capacitor is charged by a substantially direct current (DC), and wherein the second circuit comprises an inductor, a switching element, and a diode, which are operative to generate a substantially alternating current (AC) and to rectify the AC so as to charge the capacitor.

18. Apparatus according to claim 13, and comprising a battery supplying a battery voltage, wherein the first circuit comprises a resistive element through which the capacitor is charged by a substantially direct current (DC), and wherein the second circuit comprises an inductor, a switching element, and a diode, which are operative to generate a substantially alternating current

(AC) and to rectify the AC so as to charge the capacitor, wherein the first voltage is a predetermined fraction, greater than 0 and less than 1, of the battery voltage, and wherein the predetermined differential potential is greater than the battery voltage.

19. Apparatus for stimulating a tissue, comprising:

a capacitor;

circuitry which is adapted to:

charge the capacitor to a potential,

discharge the capacitor for a discharge period through the tissue; and

a resistive element, having a resistance which is controlled by the circuitry, and which is coupled to the capacitor and which is adapted to short-circuit the capacitor responsive to a control signal generated by the circuitry.

20. Apparatus according to claim 19, wherein the circuitry is adapted to generate the control signal at a time so as to implement a predetermined stimulation level to the tissue.

21. Apparatus according to claim 20, wherein the time directly follows a completion of the discharge period.

22. Apparatus for measuring a voltage, comprising:

a battery which supplies a direct current (DC) voltage;

a DC voltage reference source, which generates a substantially invariant reference voltage, and which is powered by the battery;

an analog-to-digital converter (ADC) which generates a digital value responsive to receiving the reference voltage as an analog input, and which is powered by the battery;

a memory, comprising an ADC look-up table having a

one-to-one mapping between the digital value and the DC voltage; and

a processor, which is adapted to use the ADC look-up table to determine the DC voltage responsive to the digital value.

23. Apparatus according to claim 22, wherein the ADC look-up table comprises a further one-to-one mapping between the digital value and a multiplicative correction factor which is operative to multiply the digital value so as to generate an improved digital value, and wherein the ADC is adapted to receive an alternative DC voltage and to generate an alternative digital value responsive thereto, and wherein the processor is adapted to determine the alternative DC voltage responsive to the alternative digital value and the multiplicative correction factor.

24. Apparatus according to claim 23, and comprising a plurality of resistors acting as a voltage divider which generate the alternative DC voltage, and wherein one of the resistors comprises an internal resistance of the ADC.

25. A method for changing a potential across a capacitor by a predetermined differential potential in a predetermined time period, comprising:

providing a first circuit which is adapted to charge the capacitor to a first voltage;

providing a second circuit which is adapted to charge the capacitor to a second voltage;

measuring a potential on the capacitor;

determining a first charging period for the first circuit and a second charging period for the second circuit, responsive to the potential, so that the first and second charging periods substantially total to the

predetermined period and so that the first and second voltages substantially total to the predetermined differential potential; and

operating the first circuit for the first charging period and the second circuit for the second charging period, the circuits being operated sequentially.

26. A method according to claim 25, and comprising storing a first charging rate for the first circuit and a second charging rate for the second circuit in a memory, and wherein determining the first charging period and the second charging period comprises determining the charging periods responsive to the first and the second charging rates.

27. A method according to claim 25, wherein the first circuit dissipates a first energy to charge the capacitor to the first voltage and the second circuit dissipates a second energy to charge the capacitor to the second voltage, and wherein determining the first charging period and the second charging period comprises determining the charging periods responsive to the first and the second energies.

28. A method according to claim 27, wherein determining the charging periods comprises determining the charging periods so that a sum of the first and the second energies is a minimum.

29. A method according to claim 28, wherein the first circuit comprises a resistive element through which the capacitor is charged by a substantially direct current (DC), and wherein the second circuit comprises an inductor, a switching element, and a diode, which are operative to generate a substantially alternating current (AC) and to rectify the AC so as to charge the capacitor.

30. A method according to claim 25, and comprising

providing a battery that supplies a battery voltage, wherein the first circuit comprises a resistive element through which the capacitor is charged by a substantially direct current (DC), and wherein the second circuit comprises an inductor, a switching element, and a diode, which are operative to generate a substantially alternating current (AC) and to rectify the AC so as to charge the capacitor, wherein the first voltage is a predetermined fraction, greater than 0 and less than 1, of the battery voltage, and wherein the predetermined differential potential is greater than the battery voltage.